

The LOGIC  
of the

**Dean**

THE  
WILLIAM B. PIERCE CO.  
BUFFALO, N.Y.







# THE LOGIC

OF THE



A BOOKLET, FOR THE MANAGE-  
MENT AS WELL AS THE ENGINEER,  
DISCUSSING THE EVILS OF SCALE  
AND DESCRIBING THE EFFICIENT  
DEAN WAY OF REMOVING IT

THE  
WILLIAM B. PIERCE CO.  
BUFFALO, N. Y.



*“Boiler Scale is something that cannot be trifled with, the results produced by it cannot be deferred or changed by theory or argument; it is not an imaginary condition; the results are not only very real, but tangible in every sense of the word. Furthermore, procrastination is not only likely to prove very expensive but deadly, and more than one poor fellow has given his life as the price of attempting to put off giving proper attention to the removal of boiler scale until a more convenient time.”*

*—The Southern Engineer.*



## Plain Facts for the Manager and His Engineer

**I**N this booklet, we endeavor to present to the management of the plant, and the engineer in charge of the boiler room, a few pertinent facts concerning scale and how it may be removed.

Much that is said, the experienced engineer will readily recognize. A reading of it will serve simply to refresh his memory. But to the newcomer, to the many engineers who yet do not fully grasp the dangers of scale, and to the careful manager who is responsible for efficient, economical results, and who realizes that upon effective boiler operation depends the manufacturing end of his business, it is hoped that the following pages will be of interest and value.

In preparing the booklet, the tendency has been to understate rather than to exaggerate. Every effort has been made to secure accurate and reliable data. The best engineering authorities were consulted freely, and to these have been added our own nearly twenty years of experience, furnishing many thousands of tube cleaners to boiler plants located all over the world.

## The Formation of Scale Cannot Be Prevented

**U**P to the date this booklet is written, nothing has been discovered or invented that will absolutely prevent the formation of scale on or in boiler tubes. While many claims are made that scale can be entirely prevented by the use of various methods and devices, experience has shown that all such should be regarded with the gravest suspicion. Scale will form despite the most desperate and costly efforts, just as surely as night follows day.

Engineers are often heard to say: "My feed-water is pure; I have no



scale." Theoretically, it is possible to secure "pure" feed-water, although the cost would be almost prohibitive; practically, there is no such thing as pure feed-water—that is, water entirely free from foreign matter that deposits itself on or in boiler tubes when the water is turned into steam.

This "pure water" ideal is somewhat rudely shattered when it is thoroughly understood that water is the most universal solvent known to science. Quickly, eagerly, to the point of saturation, it absorbs all kinds of gaseous, vegetable and mineral matter. Flowing down from the hills, seeking its level on the lowlands, passing through or over the earth, it inevitably becomes loaded with varying quantities of foreign matter. You unconsciously think of fine, clear artesian well water as being absolutely pure. So it is—for drinking purposes. But it travels long distances through the earth, filters through fine sand until every particle of gaseous and vegetable impurities is eliminated. But the mineral matter remains and for that reason artesian well water is called "hard"—because it is so heavily charged with minerals that, upon evaporation, a hard, flinty layer is deposited on or in the boiler tubes.

Scientific analysis shows that all feed-water used for making steam in boilers contains a certain amount of mineral matter which, when the water is boiled and passes off as steam, deposits on or in the tubes. This deposit is, for all practical purposes, nothing more than solid rock, the danger of which to the boiler, as well as to the plant employees, cannot be too strongly emphasized.

## The Relation of Scale to Fuel Consumption

Eminent authorities agree that a layer of scale one-tenth of an inch thick, and a steel boiler plate ten inches thick, offer exactly the same resistance to the passage of heat.

Putting it more vividly, boiler scale offers about 100 times the resistance that a steel plate does to heat, thicknesses being equal!

Is it any wonder, then, that after a thorough cleaning of their boiler tubes, many plants find they can generate exactly the same volume of



steam with one, two and even three boilers less? The amazing thing, to us, is that so many engineers are still willing to allow that scale to accumulate to thicknesses ranging from one-eighth inch to one-half inch before taking steps to remove it. The fuel waste will range from 10 per cent. to as high as 50 per cent., the danger to the people connected with the plant will be great, and the life of the tubes shortened fully 50 per cent.

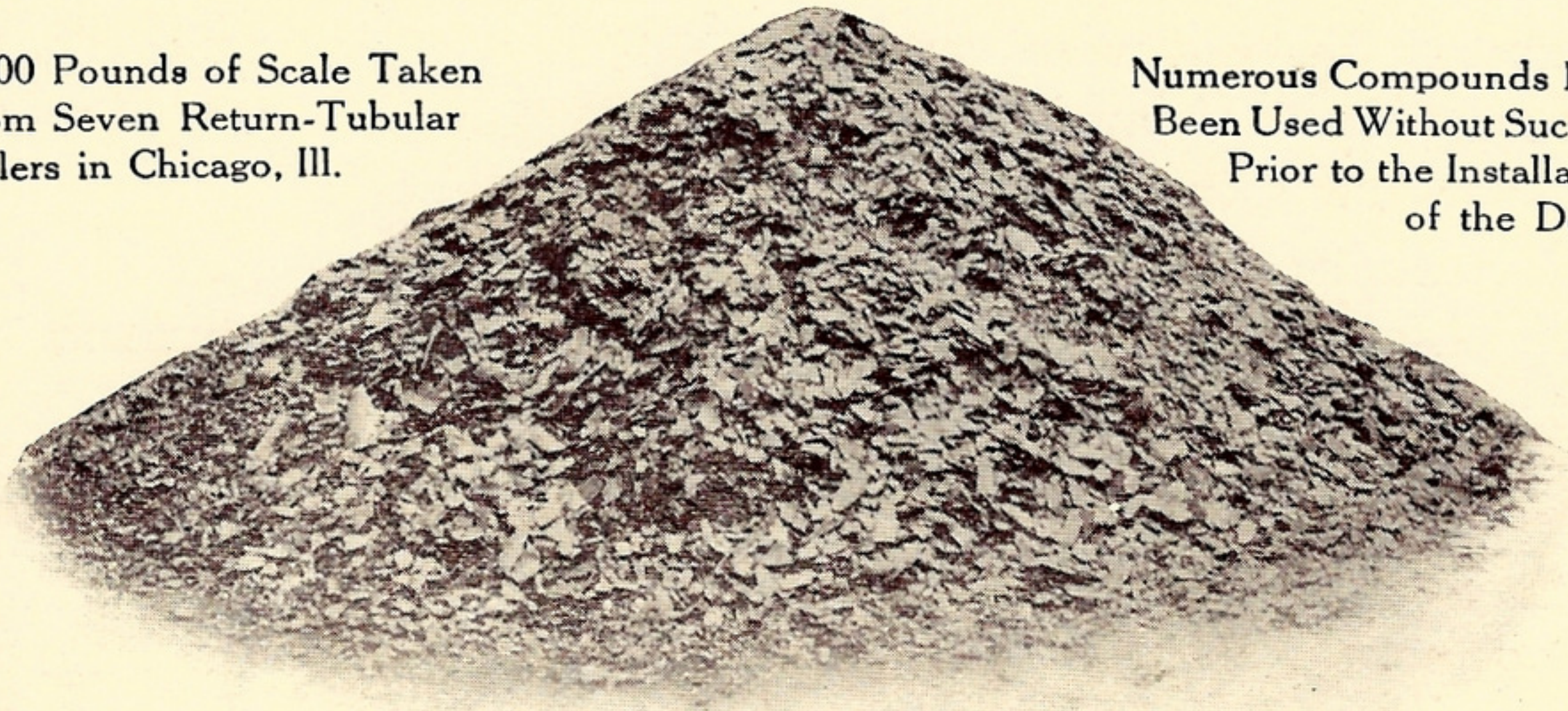
## How Shall Scale Be Removed?

Chemicals of various kinds, called "compounds," have been widely used. The engineer of experience, who has been "through the mill," knows just what they are worth and either uses them very sparingly or discards them altogether. Compounds will be discussed in greater detail on the next page.

Long and bitter experience, however, has convinced a majority of owners and operators of steam boilers that the only sure method of scale removal is mechanical. In this connection, "Steam" published by The Babcock & Wilcox Co., of New York, says: " \* \* \* for, though a rapid circulation of water (in the boiler) will delay the deposit, and certain chemicals will change its character, the most certain cure is periodical inspection and mechanical cleaning."

6,000 Pounds of Scale Taken  
From Seven Return-Tubular  
Boilers in Chicago, Ill.

Numerous Compounds Had  
Been Used Without Success  
Prior to the Installation  
of the Dean.





## Some Things That Compounds Will and Will Not Do

THE great drawback to the use of nearly all compounds, in addition to their high cost, is that they contain, in some form, acids that are extremely injurious to the boiler tubes and shell.

Many vegetable compounds contain tannic acid. Others contain acetic acid. Both of these acids are known to be great scale removers. Both of them, also, are equally sure death to whatever iron or steel with which they come into contact!

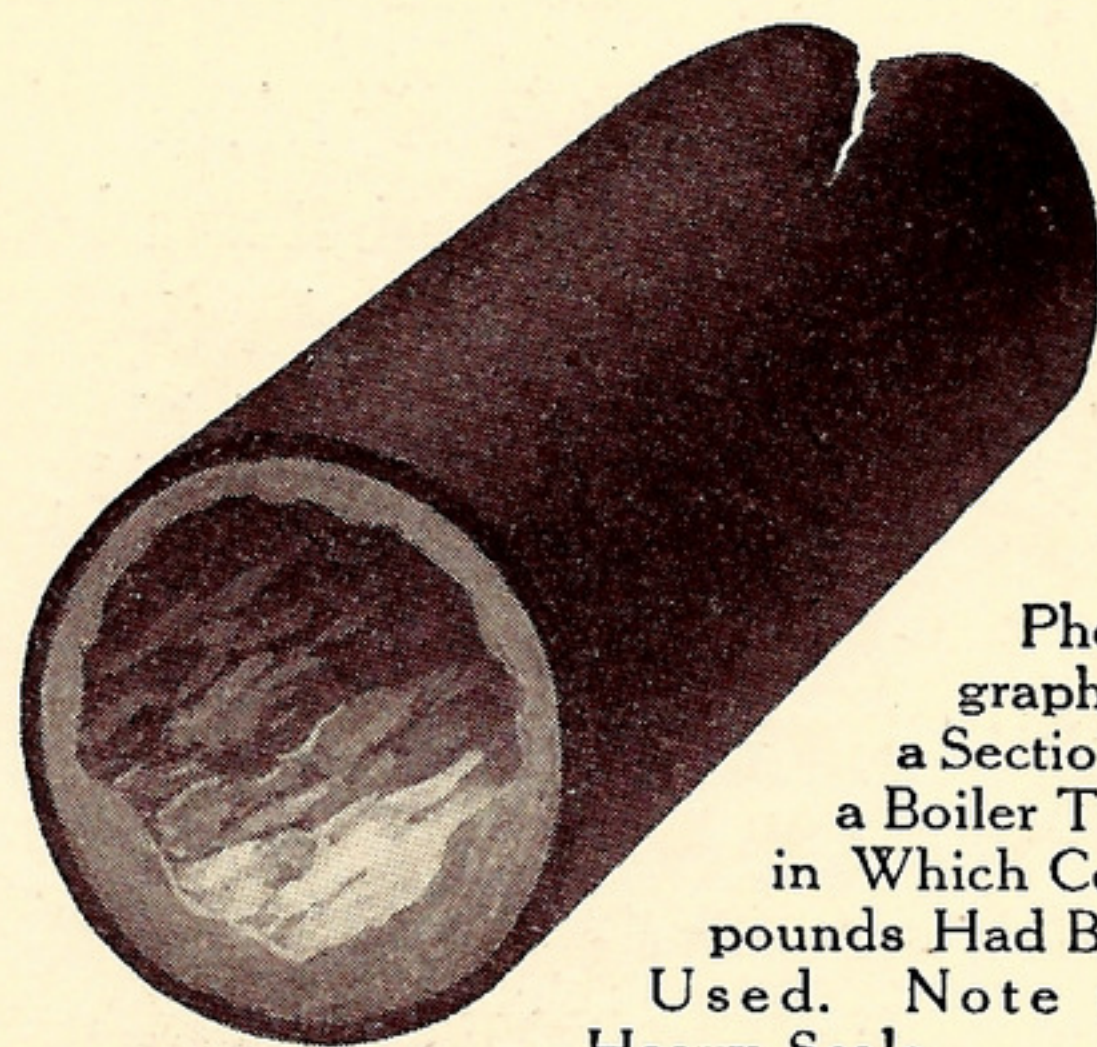
Soda ash, which has been recommended highly by some users, is one of the chief aids to foaming, which causes injurious corrosion. This renders it just as objectionable as the acids.

Muriatic (hydrochloric) acid, also extensively used, is probably more injurious to the boiler than any of the other chemicals. It instantly attacks the metal and soon destroys it.

One authority says: "Never use any boiler compound unless you know positively just what it is composed of and how it will affect the impurities in your boiler and the boiler itself."

Another states: "All secret compounds for removing boiler scale should be avoided."

William Kent, in "Steam Boiler Economy," sums up the compound situation from a sane and soundly economic point of view: "These chemicals (caustic soda and tannate) form the base of many of the 'boiler compounds,' some of which may cure the disease, while many will not,



Photograph of a Section of a Boiler Tube in Which Compounds Had Been Used. Note the Heavy Scale.



although they are sold at a very high price compared with the market value of the chemicals."

The question you must solve for yourself, then, is whether you will use compounds, constantly pouring out good money for an article you could buy around the corner at a third of the price, and taking your chances on the compound "curing" or "killing" the patient, or not use them, but rely upon mechanical cleaning (which is a one-time expense) and preserve the life of your boilers indefinitely.

## The Fallacy of Graphite

**D**URING recent years, various preparations, using graphite as a base, have appeared on the market, claiming to treat the scale in a mechanical way. How the graphite works its way through a hard, flint-like surface of scale and down to the metal of the tube, the vendors do not divulge. Neither do they explain what happens to the mineral matter contained in the graphite itself.

As a matter of fact, graphite, like compounds, may or may not act effectively, and the engineer has no possible way to determine its real value except by means of a mechanical tool.

Considering the dangers, the possibilities of gross neglect and carelessness in using these so-called "treatments," as well as their general ineffectiveness as scale removers (and not overlooking their excessive continuous cost), the intelligent manager and the conscientious engineer of to-day are turning to the sensible, sure and thorough mechanical cleaning for relief.



## Some Kinds of Mechanical Cleaners

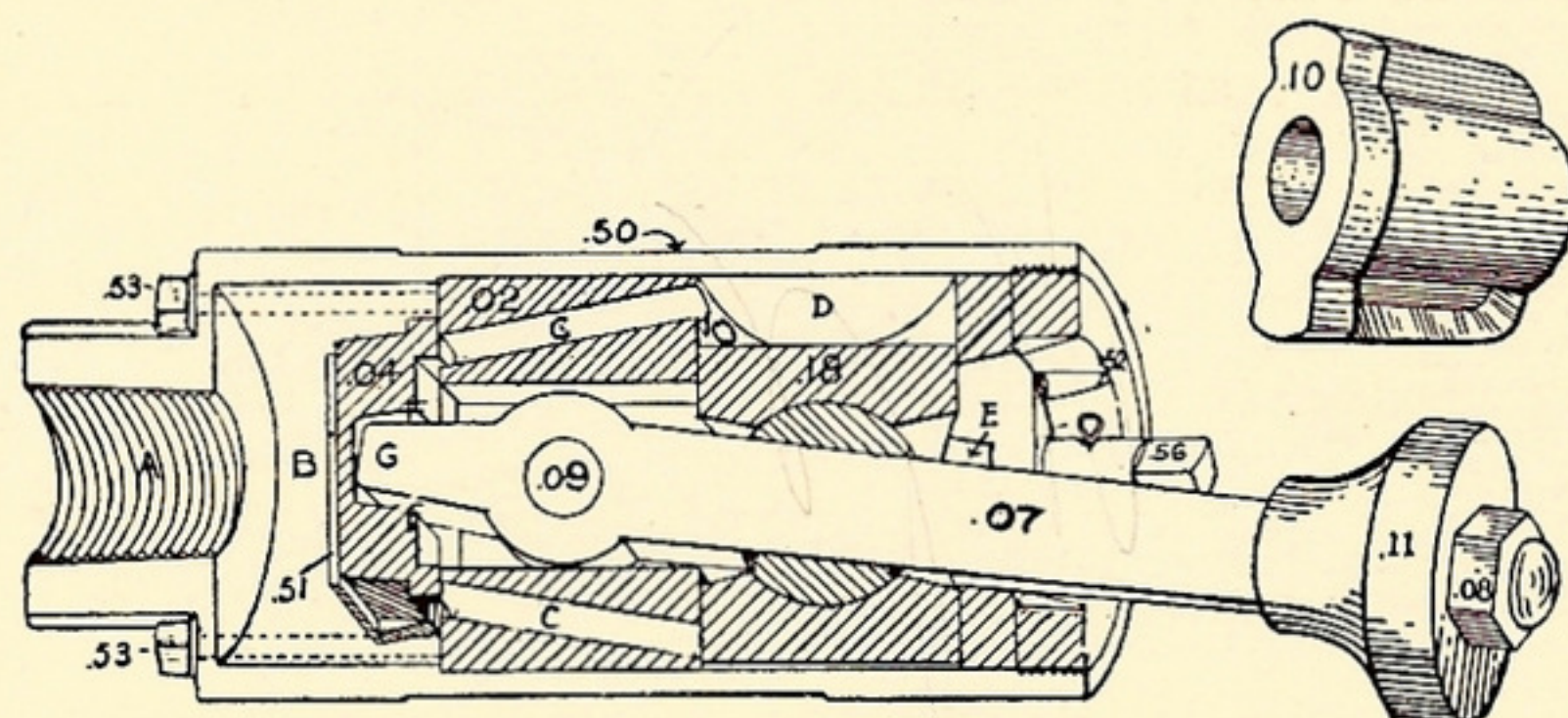
**I**F you wanted to remove a layer of solid rock from the foundation of your house, would you take your penknife and start scraping it away? And yet, absurd as that sounds, that is one of the methods employed to-day in an attempt to remove hard, stony scale from water-tube boilers. A lot of sharp cutters rotating rapidly, on the turbine principle, are supposed to grind the scale out. In a majority of cases, this method is but partially effective. Where the scale is extremely hard, it is impossible to get all of it out with the turbine type of cleaner. The top soft, spongy layer, it will remove quickly, although at a considerable expense for new cutter heads; but it leaves a thin, hard layer next to the tube that is particularly dangerous, because it cannot be seen, and the engineer then thinks his tubes are clean. During an experience of nearly twenty years with the Dean Cleaner, we have found that it will invariably remove more scale from water-tube boilers that have just been cleaned (?) with the turbine.

Another method, applicable only to fire-tube boilers, is a semi-flattering imitation of the Dean. This type of cleaner strikes the tube wall a continuous blow, without recoil and without providing for absorbing the shock. Also, the operating principle is such that one side of the tube receives a harder blow than the other side. This frequently leads to serious distortion of the tube. There are also several other so-called "knocker" types of cleaners, all of which attempt to follow as closely as possible the operating principle of the Dean.

The third method is the Dean Cleaner. This operates on the well-known principle of vibration. Its great advantages are that it is impossible for any scale, no matter how thick or thin, to resist its action, while the force of the light blow it strikes is so regulated that it cannot do the slightest injury to a boiler tube, unless, of course, the tube is already seriously decayed as a result of overheating caused by scale. A detailed description of the Dean for various kinds of work will be found in the following pages.



# DEAN BOILER TUBE CLEANER



Sectional View of the Dean.

## How It Works and What It Cleans

THE Dean Cleaner is a pneumatic vibrator, operated on the principle of the steam engine, and is driven either by compressed air or steam at varying pressures, depending upon the character of the work to be done.

Its vibratory action is secured by forcing the vibrator back and forth at speeds ranging from 3,500 to 10,000 times per minute. The resulting rapid movement of the vibrator communicates a series of vibrations to the boiler tube. The tube, being steel and elastic, vibrates in unison. Scale, however, is non-elastic and will not vibrate. Hence, the scale is forced to give up its tenacious grip upon the tube, quickly disintegrates and breaks up into small pieces. In water-tube boilers, it is blown out by the exhaust. In fire-tube boilers, it falls to the bottom of the boiler.

The Dean will remove scale thoroughly from ten to thirty tubes per hour. Much depends, of course, upon the character and thickness of the scale, and the facility of the operator in following instructions for proper use of the tool.

While other manufacturers of tube cleaners are compelled to make special designs and a multitude of accessories to adapt their cleaners to different kinds of work, the Dean, using the one principle, may be used successfully to clean the following:

Water-tube boilers.  
Stirling boilers.  
Condenser tubes.

Locomotive arch tubes.  
Superheater tubes.  
Return-tubular boilers.  
Porcupine boilers.

Evaporator tubes.  
Locomotive boiler tubes.  
All curved tube boilers.



## The Dean for Water-Tube Boilers

THERE is a big difference between boring scale out of a water-tube and shaking it off with a Dean Cleaner.

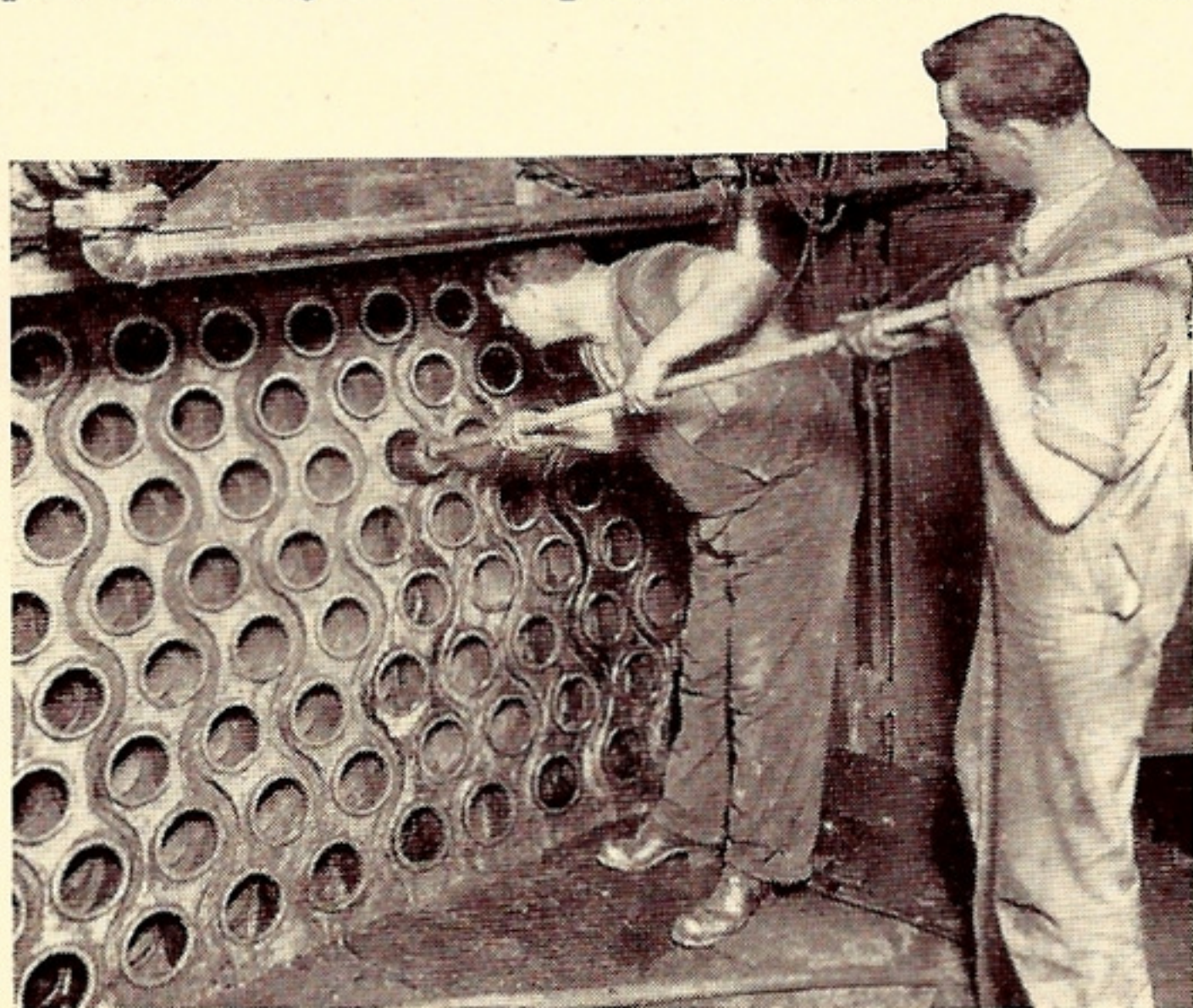
And it is just this difference in favor of the vibrating Dean that marks the clear distinction between low and high steaming capacity, many frequent repairs or few, and an excessive or moderate annual fuel bill.

The illustration at the top of the next page shows the Dean Cleaner operating in a water-tube boiler. The striking surface of the vibrator taps the tube wall just back of the scale at a tremendous rate of speed, loosening the grip of the scale and breaking it up into small pieces, which are easily blown out by the exhaust.

With this method of cleaning, the scale is removed in pieces from the tube, and so thoroughly that, upon examination, it is hard to detect even the smallest particles adhering to the tube.

Further, while removing scale from the inside of the tube, the Dean also shakes the soot off the outside. No other cleaner than the Dean performs this double function in one operation.

The remarkable success of the Dean vibratory method has been proven beyond dispute in numerous competitive tests, in which it has

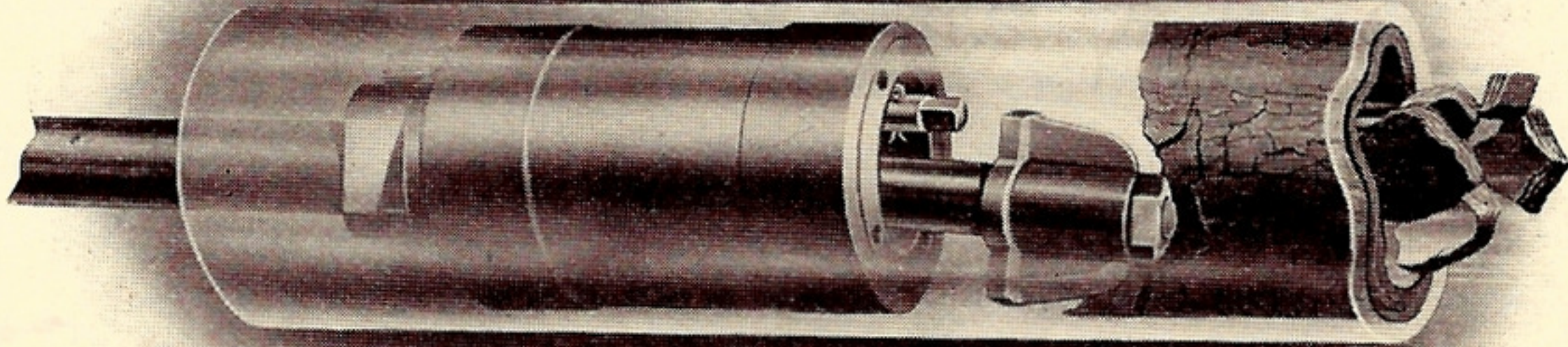


The Dean Removing Scale and Soot From the Tubes of a Water-Tube Boiler.

been found that the Dean will remove large quantities of scale from tubes previously supposed to have been cleaned by turbines, compounds, graphite, and the like.

It must be remembered that, in water-tube boilers, there is nearly always a thin, but extraordinarily hard layer of scale—in many cases even harder than tempered steel—





The Dean Operating in a Water-Tube Boiler.

directly next to the tube wall. The boring cleaner removes only the top soft layers, but leaves the thin, hard one. Unless this hard scale is removed completely, the tube is in constant danger of overheating and burning out. There is but one sure way to get it out thoroughly and that is by vibration—the Dean way.

The Dean Cleaner is made in different standard sizes for use in nearly every type of water-tube boiler used in the United States and Canada. All standard sizes are carried in stock for immediate shipment. Special cleaners, for boilers containing tubes of unusual sizes, can be made up and shipped within three or four days after receipt of order.

When ordering, for domestic use, be sure to give exact outside diameter of the tubes, in inches; for foreign use, the inside diameter, as well as the outside, in millimeters. Great care should be taken to insure accurate measurements, as the Dean should fit the tube snugly to do its best and most effective work.

Sizes and net prices of Dean Cleaners will be found on page 17.



## The Dean for Return-Tubular Boilers

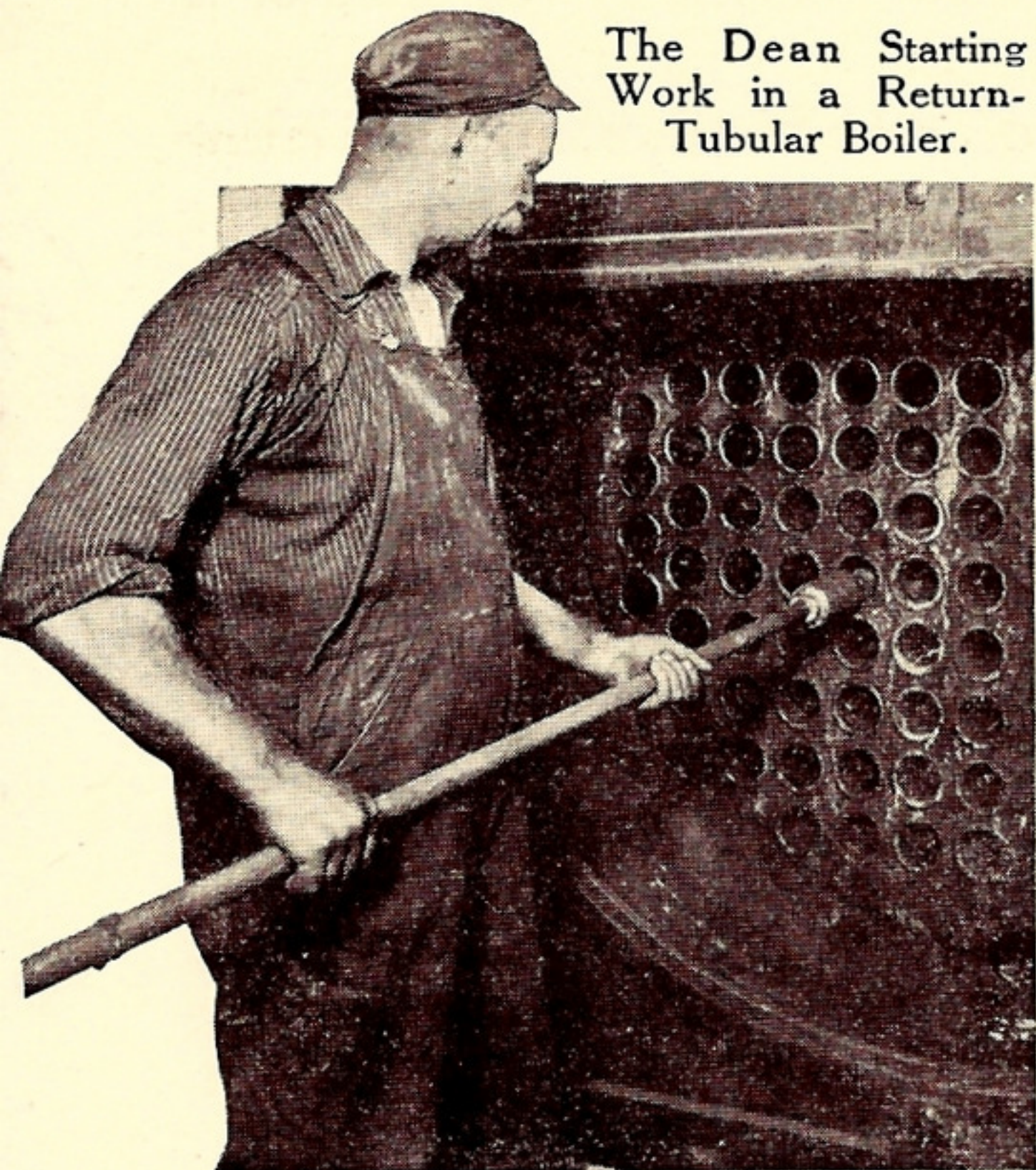
THE Dean for this type of boiler is similar to the Dean for water-tube boilers in every particular, with the exception of the vibrator, which is oval and without cutting edges.

The scale in this case is loosened from the outside of the tube surfaces and drops in large pieces to the bottom of the boiler, from which it is easily washed out.

The fact that the Dean Cleaner may be used interchangeably in fire-tube and water-tube boilers, where tubes are of the same size (and with additional attachments where there are different sizes of tubes), makes it an ideal and very inexpensive tool for plants operating both types of boilers. This is one of the many exclusive features of the Dean.

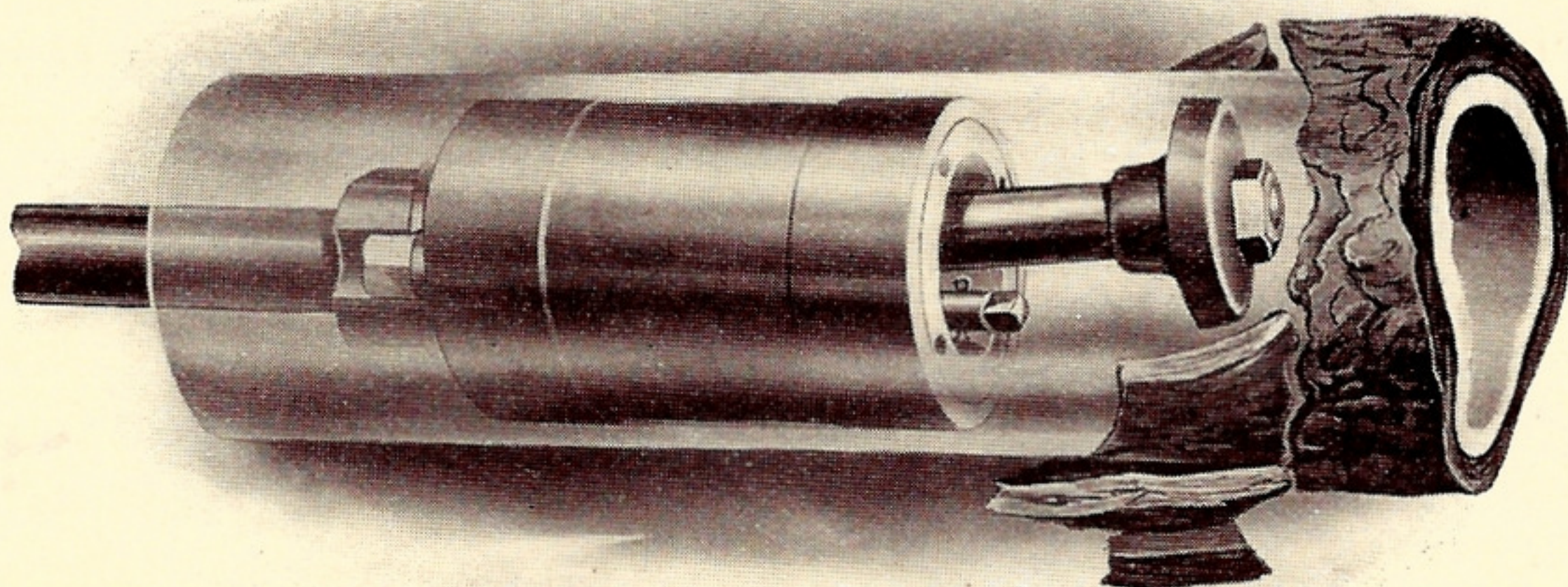
With each Dean a water-tube vibrator is furnished, so that if the soot on the inside of the tube is baked on so hard that the ordinary soot scraper or blower cannot remove it, the Dean can be used for that purpose. This is another exclusive Dean feature.

The Dean Starting  
Work in a Return-  
Tubular Boiler.



In fire-tube boilers, there is no cleaner that can compare with the Dean for effective work. It is the only cleaner that can successfully remove the scale from the tube-ends where the tube and header join. There is where scale collects heaviest and causes joints to warp apart, either through corrosion or by preventing normal expansion and contraction. These scale-covered tube-ends are extremely dangerous and frequently blow out, killing several men and completely wrecking the boiler plant—and sometimes the





The Dean Operating in a Return-Tubular Boiler.

factory as well. The regular use of the Dean will keep that scale away and make such accidents impossible.

Sometimes engineers say that, in their opinion, the Dean injures the tubes. As a matter of fact, the vibratory movement of the Dean is regulated to a mechanical nicety. The blow struck by the vibrator is so light in force that it can be taken on the bare hand without danger of the slightest injury. The average force of the Dean's blow is equivalent to  $2\frac{1}{2}$  foot ounces. If such a light tap is able to damage a steel tube  $\frac{1}{8}$  inch thick, then it is high time the engineer found it out, so that he may remove the defective tube before an exploded boiler discloses the fact.

A more technical discussion of this subject is contained in our booklet, "Does the Dean Boiler Tube Cleaner Injure the Tubes?" A copy will be sent free to anyone requesting it.

Sizes and net prices of Dean Cleaners for return-tubular boilers will be found on page 17. Standard sizes are carried in stock for immediate shipment. Special sizes can be made up and shipped within three or four days after receipt of order.

When ordering, be sure to give the exact outside diameter of the tubes to be cleaned, and state whether the tubes are welded or not. The best results can be obtained only when the right size of cleaner is used, as it must fit snugly to vibrate the tube properly.



# The Dean for Stirling Boilers

(And All Other Curved-Tube Boilers)

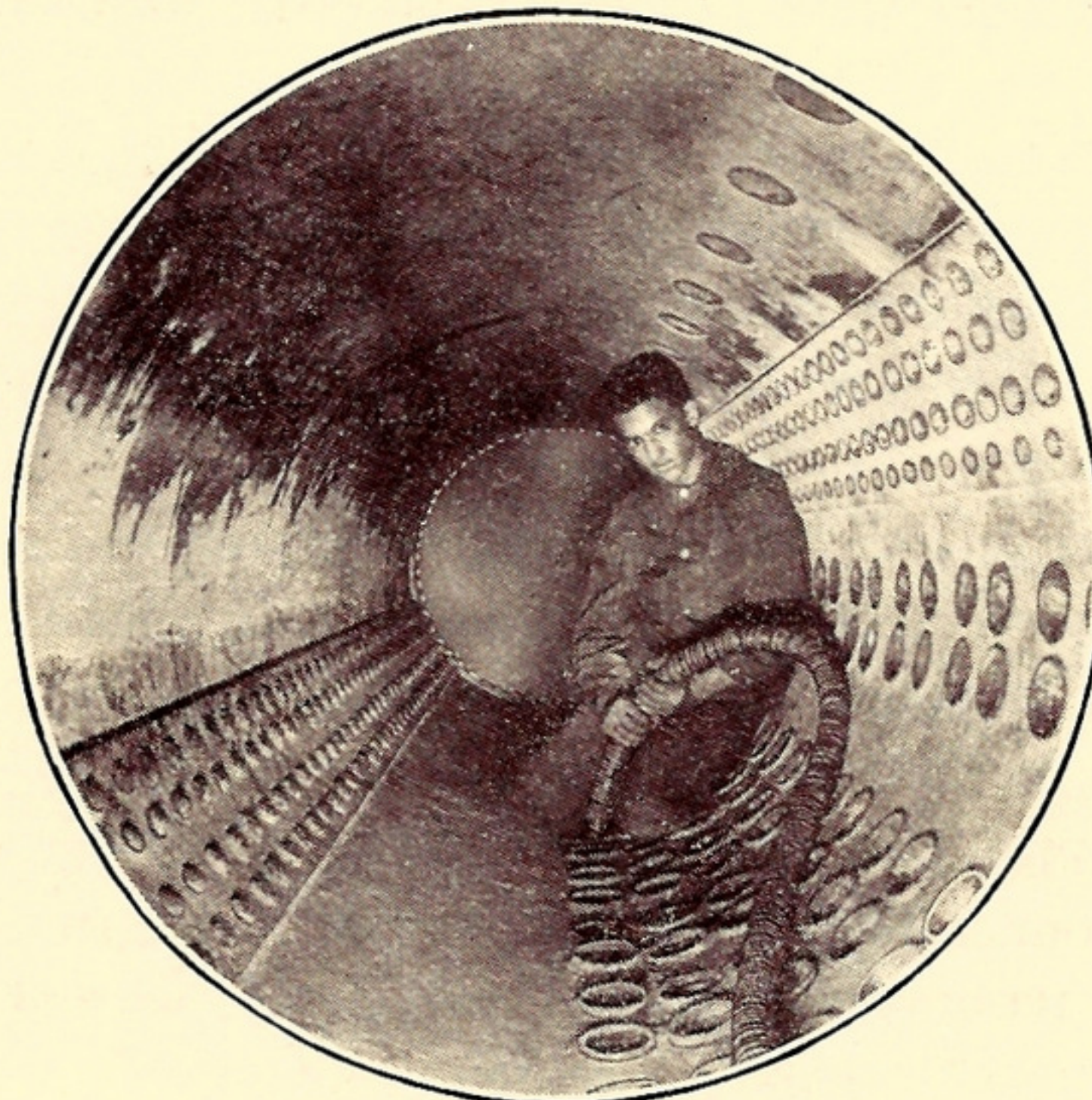
**W**HEN one really correct boiler tube cleaning principle has been developed, it is somewhat absurd to hang onto that principle a lot of accessories and incidentals to fit it for use in different types of boilers. The cleaner that will not work equally satisfactorily in all boilers is faulty in fundamental conception.

The Dean Stirling Boiler Cleaner is no different from the Dean for water and fire tube boilers, except in appearance. The barrel-shaped shell is designed to permit the tool to pass readily through the curves in the tubes. It is fitted with the regular water-tube vibrator and does its work in precisely the same manner as the regular water-tube cleaner.

The great difficulty in developing a tool to remove scale thoroughly from Stirling boilers has been to find a method that will insure complete cleanliness in the curves. Unless the curves are absolutely cleared of scale, the cleaner is totally ineffective, because it is there that the heat is the most intense and the danger of burning out greatest.

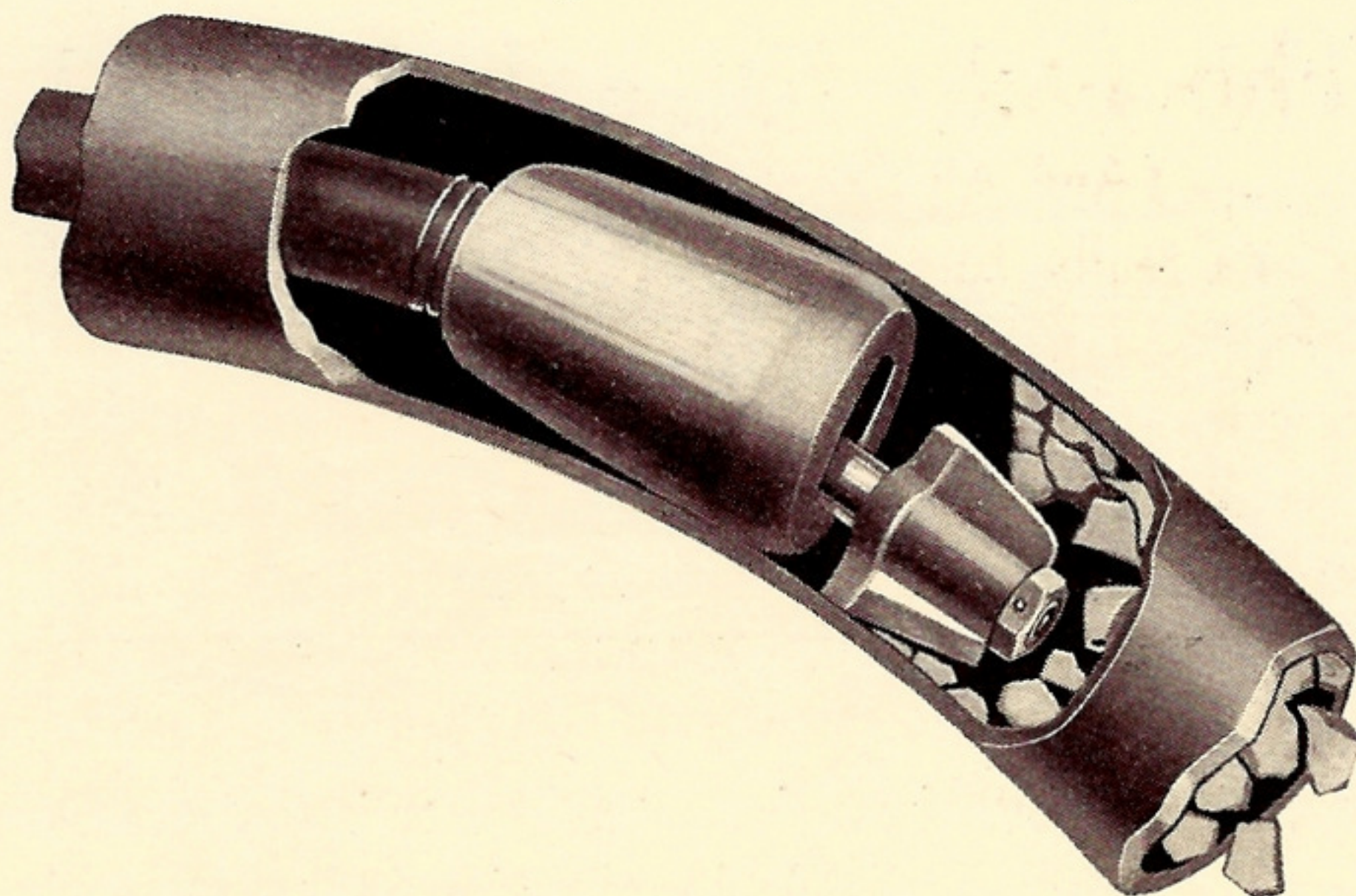
The average mechanical cleaner swings through the Stirling curve on a tangent and fails to conform itself with the shape of the bend. Thus,

Showing the Dean Stirling Cleaner Being Operated in the Drum of a Stirling Boiler.



The Dean is Fed Into the Tube by Means of Wire-Bound Hose and Cleans the Tube Thoroughly.





The Dean Operating in a Stirling Boiler Tube.

while some of the scale may be taken out, large patches of it are not touched, and burned-out tubes are sure to result.

The Dean Stirling Cleaner, however, by reason of the high speed at which it vibrates, is always kept in the exact center of the tube and, when forced into the curve, will continue to vibrate just as it does in the straight part. Hence, every particle of scale is loosened and dislodged, insuring perfect cleanliness and removing all possible danger of burning out and even more serious damage.

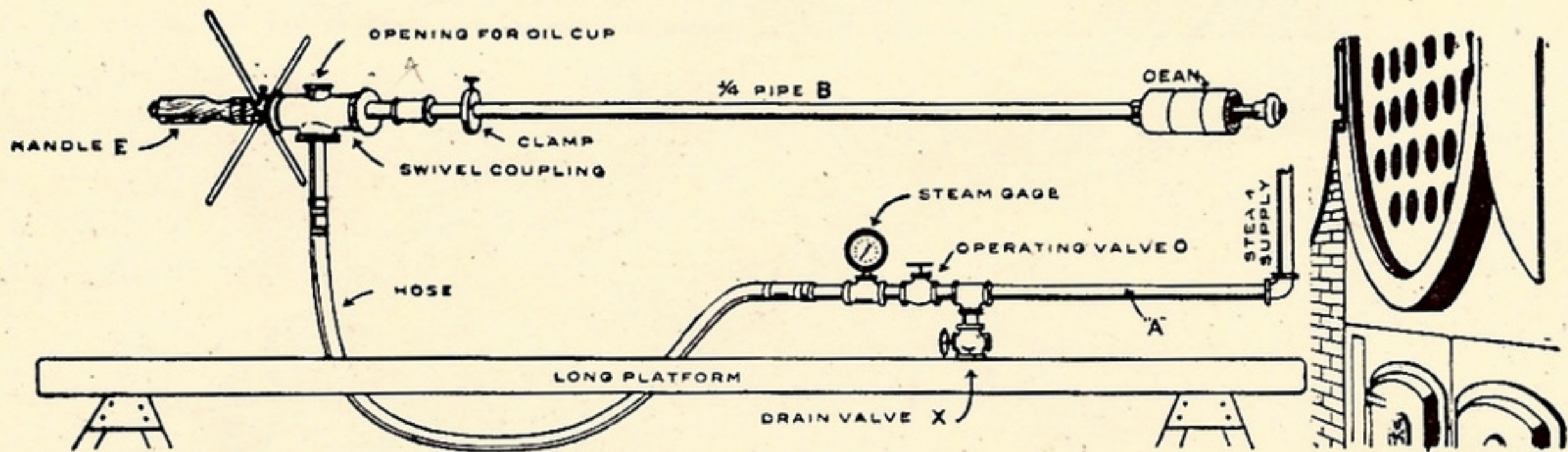
So successful has been this type of Dean Cleaner that it is now extensively used to remove scale from the curved arch tubes used in locomotives. No chances are taken with locomotives, and it is necessary to use a cleaner that entirely eliminates all possibility of scale trouble while the locomotive is in action. Our Bulletin No. 149, "The Cleaning of Locomotive Arch Tubes," will prove extremely interesting to all railroad men who are responsible for efficient results in locomotive operation.

When ordering the Dean Stirling Cleaner, don't fail to state whether there are any peculiar conditions surrounding your boilers that the Cleaner will have to meet. Whenever possible, give the radius of the sharpest curve in the boiler. While most Stirling boiler tubes measure  $3\frac{1}{4}$  inches outside diameter, it is safer to measure them and give the exact size in your order. Remember that the more information you give as to your requirements, the better will we be able to meet them.

Net price and terms will be found on page 17.



## How the Dean Is Installed



THE illustration above shows how easy it is to install the Dean Cleaner. When the space available for cleaning is less than the length of the tubes, the pipe "B" may be spliced with flexible hose and operated in the same general way. Some users, however, operate the Cleaner with plain steam hose, connected directly between the steam supply pipe and the Cleaner.

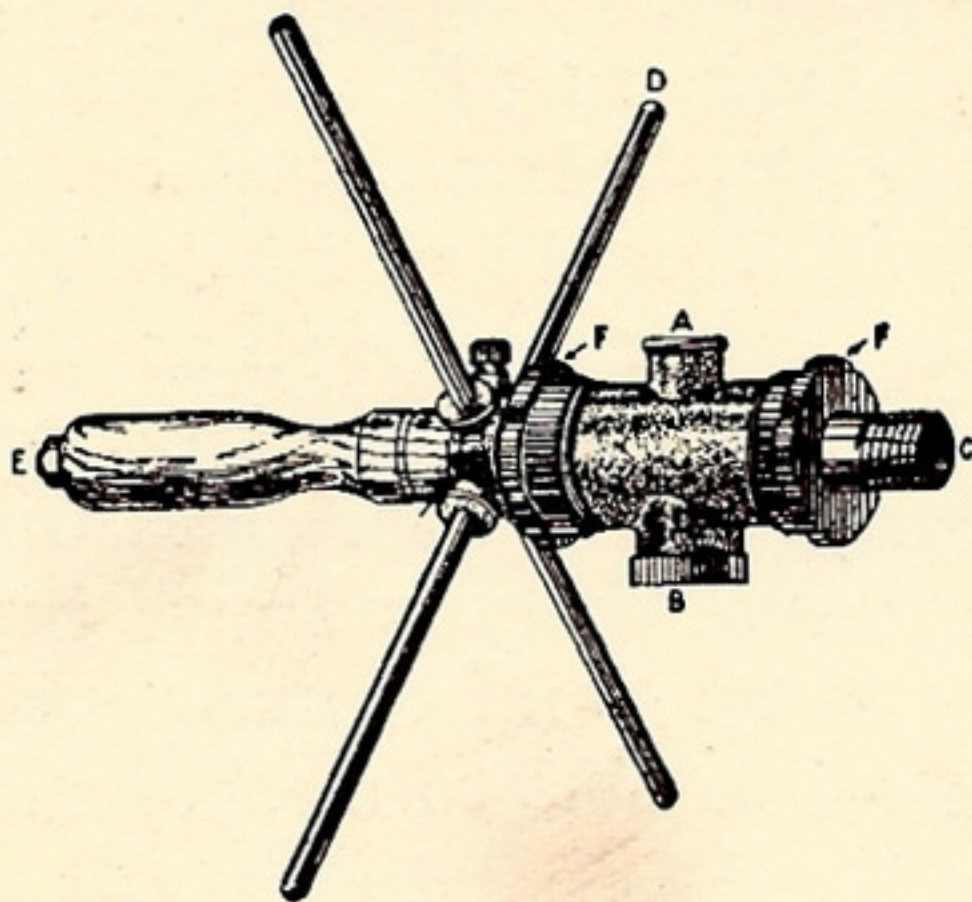
Practically everything required to operate the Dean Cleaner is already a part of the equipment of most up-to-date plants, but, if desired, we are prepared to furnish, at reasonable prices, plain, wire-bound or metallic hose, steam gauges, hose connections, nipples and oil cups.

## This Swivel Coupling Makes Work Easy

THIS Swivel Coupling is used in the manner illustrated in the cut at the top of the page. It will make the work of the operator more agreeable, enable him to handle the Cleaner with greater ease and facility.

Unless otherwise specified, it is always shipped with all Cleaners, excepting Nos. 10 and 11, or Cleaners for upright boilers, but may be returned for credit if not desired.

Price of the Coupling will be found on page 17.





## Net Price List and Terms of Sale

No. 5	for 3 in. tubes	.	.	.	.	.	.	\$ 90.00
No. 6	for 3½ in. tubes	.	.	.	.	.	.	90.00
No. 7	for 4 in. tubes	.	.	.	.	.	.	90.00
No. 8	for 4½ in. tubes	.	.	.	.	.	.	95.00
No. 8-0	for 5 in. tubes	.	.	.	.	.	.	95.00
No. 8-1	for 5½ in. tubes	.	.	.	.	.	.	100.00
No. 9	for 6 in. tubes	.	.	.	.	.	.	100.00
No. 10	for curved-boiler tubes (Stirling, etc.)	.	.	.	.	.	.	100.00
No. 11	for locomotives arch tubes only	.	.	.	.	.	.	100.00
No. 3	for 2 in. tubes	.	.	.	.	.	.	100.00
No. 4	for 2½ in. tubes	.	.	.	.	.	.	100.00
Swivel Coupling, each	(for Dean Cleaners)	.	.	.	.	.	.	10.00

TERMS: 30 days net; 2 per cent cash 10 days; prices are f. o. b. Buffalo.

The above prices and sizes apply to Cleaners both for water-tube and return-tubular boilers.

All of the above stock sizes are carried ready for immediate shipment. Shipments will be made by express unless otherwise ordered.

Any size Cleaner, between 1½ and 7 inches, outside diameter, can be furnished promptly. To determine the price, note the price of the Cleaner next larger than the size required.

Rush orders may be placed by telegraph at our expense.

CAUTION: Measure your tubes accurately; otherwise the Cleaner will not fit and an annoying delay will result.





## A Representative List of Dean Users

These are but a few of the large concerns all over the world that help to make up the 16,000 or more Dean Cleaner users:

### UNITED STATES

*(The following have from 5 to 50 Deans in use)*

American Sheet & Tin Plate Co.	Pittsburgh, Pa.
American Smelting & Refining Co.	Denver, Colo.
American Sugar Refining Co.	New York, N. Y.
American Writing Paper Co.	Holyoke, Mass.
Anaconda Copper Mining Co.	Anaconda, Mont.
Calumet & Arizona Mining Co.	Warren, Ariz.
Carnegie Steel Co.	Pittsburgh, Pa.
Colorado Fuel & Iron Co.	Denver, Colo.
E. I. DuPont de Nemours Powder Co.	Wilmington, Del.
D., L. & W. R. R. Co.	Hoboken, N. J.
H. C. Frick Coke Co.	Pittsburgh, Pa.
General Electric Co.	Schenectady, N. Y.
General Chemical Co.	New York, N. Y.
Illinois Central R. R. Co.	Chicago, Ill.
International Paper Co.	New York, N. Y.
Jones & Laughlin Steel Co.	Pittsburgh, Pa.
National Tube Co.	Pittsburgh, Pa.
New York Central Railroad Co.	New York, N. Y.
Philadelphia & Reading Coal & Iron Co.	Philadelphia, Pa.
Pennsylvania Railroad Co.	Philadelphia, Pa.
Russell-Miller Milling Co.	Minneapolis, Minn.
Swift & Co.	Chicago, Ill.
Southern Cotton Oil Co.	New York, N. Y.
Standard Oil Co., over 400 Cleaners	New York, N. Y.
Tennessee Coal, Iron & R. R. Co.	Birmingham, Ala.
United States Government	
United States Leather Co.	New York, N. Y.
United States Steel Corporation, over 500 Cleaners	
West Virginia Pulp & Paper Co.	New York, N. Y.

*(The following have several Deans in use)*

American Pipe & Construction Co.	Philadelphia, Pa.
Atlas Powder Co.	Houghton, Mich.
Borden's Condensed Milk Co.	New York, N. Y.
Chalmers Motor Co.	Detroit, Mich.
City of New York (Water Dept.)	New York, N. Y.
City of New York (Bridge Dept.)	New York, N. Y.
Cudahy Packing Co.	Omaha, Neb.
Thomas A. Edison, Inc.	Orange, N. J.
Firestone Tire & Rubber Co.	Akron, Ohio
Graton & Knight Mfg. Co.	Worcester, Mass.
H. J. Heinz Co.	Holland, Mich.
International Motor Co.	Allentown, Pa.
Kelly-Springfield Tire Co.	Akron, Ohio.
Marlborough-Blenheim Hotel	Atlantic City, N. J.
Metropolitan Opera House	New York, N. Y.
Northern Pacific Railway Co.	Livingstone, Mont.
Peerless Motor Car Co.	Cleveland, Ohio.
Regal Shoe Co.	Milford, Mass.
Sherwin-Williams Co.	Cleveland, Ohio.
The Texas Co.	New York, N. Y.
Union Iron Works	San Francisco, Cal.
University of Michigan	Ann Arbor, Mich.
University of Pennsylvania	Philadelphia, Pa.
Yale University	New Haven, Conn.





## ARGENTINE REPUBLIC

Cia. Introdutora de Buenos Aires . . . . . Buenos Aires.

## AUSTRALIA

Swift & Co. . . . . Brisbane.

## AUSTRIA-HUNGARY

Austro-Hungarian State Railway . . . . . Budapest.  
Hungaria Chem. Fabrik . . . . . Budapest.

## BELGIUM

Goethals & Goethals . . . . . Eecloo.

## BRAZIL

Estrada de Ferro Central de Brazil . . . . . Rio de Janeiro.  
Rossbach-Brazil Co. . . . . Pernambuco.

## CANADA

Canadian Northern Railway . . . . . Winnipeg, Man.  
C. P. R. R. Co., 17 Cleaners . . . . . Montreal, Que.  
Imperial Oil Co., 3 Cleaners . . . . . Sarnia, Ont.  
Steel Co. of Canada, 4 Cleaners . . . . . Hamilton, Ont.

## CUBA

Havana Central R. R. Co., 3 Cleaners . . . . . Saqua La Grande.

## ENGLAND

Cardiff Corporation . . . . . Cardiff.  
Coventry Ordnance Co. . . . . Coventry.  
Dorman, Long & Co. . . . . Middlesborough.  
Moresby Coal Co. . . . . Whitehaven.

## GERMANY

German State Railway Shops . . . . . Berlin.  
Krupp's Gun Works . . . . . Essen.

## JAPAN

Sudzaki Iron Works, 3 Cleaners . . . . . Tokyo.  
Taiwan Sieto Kabushuki, 7 Cleaners . . . . . Kwaisha, Tokyo.

## MEXICO

Cananea Consolidated Copper Co., 17 Cleaners . . . . . Cananea.  
Cia. Fundidora de Fierro y Acero . . . . . Monterey.  
Descubridora Mining & Smelting Co. . . . . Conejos.  
El Oro Mining & Railway Co. . . . . El Oro.  
Mazapil Copper Co., 11 Cleaners . . . . . Saltillo.

## NORWAY

Krogstad Cellulosefabrik . . . . . Mjondalen.  
Skien Cellulosefabrik . . . . . Skien.  
Union Co., 3 Cleaners . . . . . Skien.

## PERU

Cerro de Pasco Mining Co. . . . . Callao.

## PHILIPPINE ISLANDS

Fabrico de Hielo . . . . . Manila.  
War Dept., Govt., Philippine Islands . . . . . Manila.

## RUSSIA

Moscow-Kasan Railway Co. . . . . Moscow.  
Nikolaewski Railway Co. . . . . Petrograd.  
Rjasan-Uralsk Railway . . . . . Saratow.  
Petrograd-Vologda Railway Shops . . . . . Vologda.  
A. M. Luther Woodworking Co. . . . . Reval.





## Try Before You Buy

**Y**OU cannot appreciate how much more effective, how thoroughly it will clean your tubes and how durable the Dean Cleaner is, in comparison with other means of removing scale, until you have used it in your own plant.

We will loan you a Dean, therefore, for free trial in one boiler, without charge and without asking you to assume even the slightest obligation to purchase, regardless of how satisfactory the trial may turn out.

When you order the Dean for trial, you and you alone will be the judge of its value to your plant and special scale conditions.

Whatever may be your present method of removing scale, a trial of the Dean will open your eyes to a better, more thorough and much more economical way.

## THE WILLIAM B. PIERCE COMPANY

45 NORTH DIVISION STREET

BUFFALO, N. Y.

### A Broad Guarantee

*In the event of purchase after trial, we guarantee the Dean to pay for itself in six months' use, and agree to take back the machine and return the purchase price in full if, in the judgment of the purchaser, it has not paid for itself in that time.*



Known Patent Numbers for  
Cyrus S. Dean Steam  
Boiler Cleaners:  
507421; 526648;  
561497; 580774;  
580775; 580776;  
645894; 647131;  
771613; 821613;  
834459; 838088;  
and 864772

Posted on November 17, 2020  
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